forest management note

Note No. 17 Northern Forest Research Centre Edmonton, Alberta

# DIURNAL ADJUSTMENT TABLE FOR THE FINE FUEL MOISTURE CODE[1]

Daily fire weather observations taken at 1300 daylight saving time (1200 local standard time) are used with the Canadian Forest Fire Weather Index (CFFWI) tables (Anonymous 1978) as a general guide in support of various fire prevention, detection, and preparedness planning activities for large protection areas. The CFFWI ratings are intended to apply to conditions during the peak fire danger period, which normally occurs shortly after midafternoon. Knowledge of certain CFFWI component values at other times of the day can also aid site-specific fire management decisions with respect to prescribed burning and wildfire suppression operations.

The main requirement for round-the-clock assessment of fire danger is the estimation of fine fuel moisture content, represented by the Fine Fuel Moisture Code (FFMC), as it varies throughout the 24-h diurnal cycle. Muraro et al. (1969) designed such a scheme, which was later developed into an FFMC diurnal adjustment table by Van Wagner (1972). A slightly modified version of that table is reproduced as Table 1 in this note. Some familiarity with the CFFWI on the part of the user is presumed.

The FFMC diurnal adjustment table makes it possible, in the absence of rain, to estimate the FFMC at various times of the day and, in turn, calculate the Initial Spread Index (ISI) and the Fire Weather Index (FWI). No allowance is made for rain. If there is appreciable rain after 1300, the whole procedure is invalid but then there is less need for current code and index values. If the amount of rain is small (less than 0.6 mm), the resulting current FFMC, ISI, and FWI ratings may be of use as maximum limits.

The effect of incomplete overnight recovery of relative humidity on fine fuel moisture is accounted for in the FFMC diurnal adjustment table. FFMCs for morning times following nights with much less than 100% relative humidity will be higher than FFMCs calculated after full recovery. These higher FFMC values correspond to the lower fine fuel moisture contents generally associated with reduced overnight recovery. The effect of low overnight humidity is assumed to have disappeared by midafternoon; therefore, FFMCs for afternoon times do not require a special relative humidity measurement, only the basic daily observation at 1300.

The FFMC diurnal adjustment table uses the latest standard determination as a starting point. The 1700 FFMC values given in Table 1 are the same as the column headings for the standard daily FFMC value determined at 1300; the actual basic observation time FFMC value given in the 1300-h row is somewhat lower. This is because the standard 1300 determination is projected to apply to the time of assumed maximum fire danger at approximately 1600 to 1700. This generally coincides with the time of day when the moisture content of fine dead forest fuels reaches a minimum point. Table 1 gives diurnal trends for initial FFMC values of 50 and above. Below this starting point, fine fuel moisture contents are too high to be of any interest or concern. For times during the afternoon and evening (1300 to 2100), a single humidity trend is assumed, and only one value of FFMC is given for each initial value and time of day. For the morning hours 0700, 0900, and 1100, Table 1 provides three classes of prevailing relative humidity to allow for variation in overnight weather, which can be measured or estimated. To determine adjusted

[1] This note is a revision of material that originally appeared as regional supplements (entitled *Adjusted Fine Fuel Moisture Code and Fire Weather Index for Times Throughout the Day*) to the Canadian Forest Fire Behavior System, now called the Canadian Forest Fire Danger Rating System. They were issued by the Pacific Forest Research Centre, Victoria, British Columbia, in August 1973 as Supplement BC-6 and the Great Lakes Forest Research Centre, Sault Ste. Marie, Ontario, in July 1974 as Supplement ONT-3.

FFMC values for times of day not listed, interpolate between adjacent rows.

The FFMC for some time other than the afternoon peak fire danger period is determined as follows:

1. Find the column heading value in Table 1 closest to the most recent standard daily determination of the FFMC.
2. Then find the row heading for the desired time of day and the measured or estimated relative humidity (if required).
3. Where the column and row intersect, read the desired current FFMC.

Example: Estimate the FFMC for today at 0900 when the relative humidity is 70% and the standard daily FFMC determined at the basic observation time of 1300 yesterday was 92. Find the FFMC value of 92 across the top of Table 1. On the left-hand side of Table 1, locate 0900 in the Time "T" column and the appropriate relative humidity class (>67%) in the next column. Trace along the resulting row to the 92 FFMC column heading. An FFMC value of 80 is obtained at the intersection.

The ISI and FWI can be determined for some time other than the afternoon peak fire danger period using the FFMC value derived from Table 1 and the relevant CFFWI tables (Anonymous 1978). An assumption is made that there is no change of any real significance in the Duff Moisture Code, Drought Code, or Buildup Index (BUI) since the last basic observation time determination of these CFFWI components. The procedures are as follows:

1. Estimate the current FFMC as described above.
2. Measure or estimate the 10-min average wind speed (km/h) at the standard height of 10 m in the open for the time of interest.
3. Determine the ISI from CFFWI Table 7 using the current FFMC and wind speed as determined in (1) and (2) above.
4. Determine the FWI from CFFWI Table 9 using the ISI found in (3) above and the latest basic observation time value of the BUI.

Example: Determine the ISI and FWI for today at 0900. FFMC for 0900 is 80, as estimated in the previous example. Wind speed is 8 km/h, and yesterday's BUI was 50. Today's 0900 ISI from CFFWI Table 7 is then 2, and the 0900 FWI from CFFWI Table 9 is 6.

Van Wagner (1977) has developed a more sophisticated procedure for computing the FFMC for any given hour of the day if continuous hourly weather observations and a computer or programmable calculator are available. The equations for hourly calculation of the FFMC have been programmed for the Texas Instruments Model 59 hand-held calculator[2]. A note documenting operating instructions and field use is in preparation.

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*November 1982*

## REFERENCES

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[2] The exclusion of certain manufactured products does not imply rejection nor does the mention of other products imply endorsement by the Canadian Forestry Service.

**Table 1. Fine Fuel Moisture Code diurnal adjustment table (after Van Wagner 1972)**

| Time[1] "T" (h) | Relative humidity at time "T" (%) | Standard daily FFMC[2] | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 50 | 55 | 60 | 65 | 70 | 75 | 78 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 |
| | | *FFMC at time "T"* | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0700 | <68 | 58 | 59 | 60 | 61 | 62 | 65 | 67 | 69 | 70 | 71 | 72 | 72 | 73 | 74 | 75 | 76 | 78 | 80 | 81 | 82 | 83 | 84 | 85 | 87 | 88 | 90 | 92 |
| | 68-87 | 51 | 52 | 54 | 56 | 59 | 63 | 64 | 66 | 67 | 68 | 69 | 70 | 70 | 71 | 72 | 73 | 75 | 76 | 77 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 87 |
| | >87 | 45 | 47 | 49 | 52 | 55 | 59 | 61 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 74 | 75 | 76 | 77 | 79 | 80 | 81 | 82 | 83 | 85 |
| 0900 | <48 | 63 | 64 | 65 | 66 | 68 | 71 | 72 | 74 | 74 | 75 | 76 | 76 | 77 | 78 | 79 | 80 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 92 | 93 |
| | 48-67 | 53 | 55 | 57 | 59 | 62 | 66 | 68 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 91 |
| | >67 | 47 | 48 | 50 | 53 | 56 | 60 | 63 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 76 | 77 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 87 | 89 |
| 1100 | <38 | 73 | 74 | 74 | 75 | 76 | 79 | 80 | 82 | 82 | 82 | 83 | 84 | 84 | 85 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 92 | 93 | 94 | 95 | 96 |
| | 38-57 | 65 | 67 | 69 | 71 | 73 | 75 | 76 | 78 | 79 | 80 | 80 | 81 | 82 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 92 | 93 | 94 |
| | >57 | 60 | 62 | 64 | 66 | 68 | 70 | 72 | 74 | 74 | 75 | 76 | 77 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 1300 | * | 42 | 46 | 50 | 53 | 56 | 63 | 66 | 69 | 70 | 72 | 74 | 76 | 79 | 81 | 83 | 85 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 |
| 1500 | * | 46 | 50 | 54 | 59 | 64 | 70 | 74 | 76 | 77 | 79 | 81 | 82 | 83 | 84 | 85 | 86 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 |
| 1700 | * | 50 | 55 | 60 | 65 | 70 | 75 | 78 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 |
| 1900 | * | 52 | 58 | 63 | 67 | 71 | 75 | 78 | 80 | 81 | 82 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 |
| 2100 | * | 54 | 59 | 63 | 67 | 70 | 74 | 76 | 78 | 79 | 80 | 81 | 82 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 92 | 93 | 94 | 95 |

[1] Daylight saving time. Subtract one hour for local standard time. Daylight saving time is in effect for six months from the last Sunday in April to the last Sunday in October.

[2] Value determined at last basic observation time (1300).

* Relative humidity measurement or estimate not required.

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